

whole surface of the earth, and the value of an attempt at such a task would now be extremely doubtful. But for limited districts, like this country, the case is very different. It would indeed be difficult to over-estimate the value of a seismic record which can claim any approach to completeness for a definite earthquake area, however feeble the shocks which visit it may be.

I may add that I hope shortly to publish some notes or directions for the study of earthquakes, with special reference to those which occur in this country. CHARLES DAVISON.

38 Charlotte Road, Birmingham, October 10.

Effects of Lightning.

I HAVE known of the following case since July last, but owing to absence from this place have only been able to get particulars during the last few days.

During the terrific storm of the 12th of July last, a labourer's cottage was struck by lightning at Leagrave, near here. The lightning descended, according to an eye-witness's report, like a "spout of fire," and struck and descended the chimney, which it destroyed. In the room below there was an old shepherd, an invalid woman, a child, and a shepherd's dog. The shepherd was sitting in a chair leaning on a stick, a kettle was boiling on the fire, and the door was open. The lightning entered the room simultaneously by the chimney and an adjoining window. The window was utterly destroyed, and the kettle was thrown from the fire across the room, the stick on which the shepherd was leaning was torn from his hand and also thrown across the room, the lightning entered a cupboard containing glass and crockery and destroyed every article, and plaster was torn from the walls. The man and woman remained unhurt, but the child was thrown down and its knees stiffened. The dog was struck perfectly stiff, "like a log of wood," and was considered dead. The room seemed full of fire, water, and sulphur, and the occupants said the smell of sulphur was so strong that they would certainly have been suffocated had it not been for the open door. After the storm had abated, the dog, with all its limbs stiff, was laid in a barn, where it very slowly and partially recovered. It long remained both deaf and blind, and was entirely dependent upon smell for its recognition of persons and things. To the present day it has not entirely recovered its injured senses.

Dunstable.

W. G. S.

Electrical Cloud Phenomenon.

A SHORT description of a curious cloud appearance observed by me this summer may be of interest to your readers. It was noticed in Kiushu, the southernmost of the three great islands of Japan, early in July, at a distance of ten or twelve miles from the sea.

The season had been, and was, after the time of the observation, an exceptionally rainy one, severe floods being produced in almost all parts of the country, but it was not raining in the place where I made the observation at that particular time. Time shortly after midday, thermometer about 85° F.

The sky was clear overhead, but there was a great bank of heavy "thunderous" looking clouds to the south. It is most difficult to judge even approximately of the distance of clouds, but these might be from one to two miles off; the lower edge was represented by a very nearly straight line, and there was an amount of blue sky visible under the clouds that would perhaps subtend from 10° to 15°.

My attention was attracted to a sort of "tail" of cloud stretching itself downwards from the straight under side of the cloud-bank. It gradually extended till it reached some two-thirds of the distance from the cloud to the earth. It remained of about constant length for a little over ten minutes, the lower end continually waving about in a most curious way, giving the impression almost that it was feeling for something.

Quite suddenly the filament of cloud straightened itself out, and extended itself towards the earth. The lower end became so very thin that, from the distance, it was impossible to see whether it actually made contact with the earth or not, but I have not the smallest doubt that it did, and that a silent discharge took place at the time. There was certainly no sound heard. Immediately after the contact the filament rapidly drew itself up to the cloud, and was incorporated with it. Almost immediately after this, whether as a mere coincidence or not I cannot tell, the cloud discharged a great amount of rain.

W. K. BURTON.

Imperial University, Tokio, Japan.

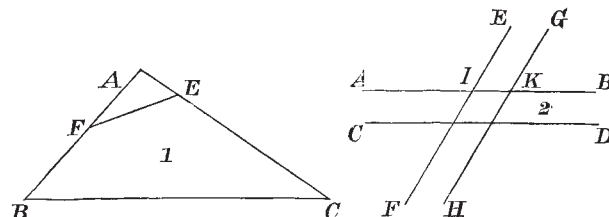
P.S.—The appearance was not unlike the illustrations of "water-spouts" that I have seen, but there was no whirling motion such as is always described as accompanying these, nor, indeed, was there any evidence of violent disturbance of any kind at all.

The Use of the Word Antiparallel.

THE following note on the use of the word antiparallel may prove of interest to the readers of NATURE.

In the second edition of "A New Mathematical Dictionary" by E. Stone, F.R.S. (London, 1743), appears a short article on antiparallels, the whole of which I will quote:—

"Antiparallels, are those lines, as FE, BC, that make the same angles AFE, ACB, with the two lines AB, AC, cutting them, but contrary ways, as parallel lines that cut them. But Mr. Leibnitz, in the *Acta Erudit.*, An. 1691, p. 279, calls antiparallels those lines (see Fig. 2) as EF, GH, which cut two parallels AB, CD; so that the outward angle AIF, together with the inward one AKH, is equal to a right angle. When



the sides AB, AC, of a triangle, as ABC (Fig. 1), are cut by a line EF antiparallel to the base BC, the said sides are cut reciprocally proportional by the said line EF; that is, $AF : BF :: EC : AE$, the triangles AFE, ABC being similar or equiangular."

The error in regard to the ratios of the segments of the sides is the same as the one noted in Hutton's "Miscellanea Mathematica," as quoted by Mr. Langley. I have no doubt that earlier instances of the use of this word can be found, and I would like to know whether the word is used in the first edition of "Stone's Dictionary."

W. J. JAMES.

Wesleyan University, Middletown,
Conn. U.S.A., October 15.

Fossil Rhizocarps.

IN Bennet and Murray's "Cryptogamic Botany," at p. 115, I am surprised to find in a reference to my paper on "Fossil Rhizocarps" (in *Bull. Ac. Sciences, Chicago*) the statement, with reference to the macrospores of *Protosilvinia*, that "inasmuch as they are borne on *Lepidodendron* scales this reference is inadmissible." Now no such fact has come to my knowledge, and on the contrary these bodies are found inclosed in cellular sporocarps like those of *Salvinia*, and are so described in the paper in question. If anyone has found them on "scales of *Lepidodendron*," the authority should have been stated.

Montreal, October 15.

J. WM. DAWSON.

Specific Inductive Capacity.

ON p. 669 of Ganot's "Physics" (eleventh edition) the following statement is found:—"At a fixed distance above a gold-leaf electroscope, let an electrified sphere be placed, by which a certain divergence of the leaves is produced. If now, the charges remaining the same, a disk of sulphur or of shellac be interposed, the divergence increases, showing that inductive action takes place through the sulphur to a greater extent than through a layer of air of the same thickness."

If this statement were correct, there should be less electric action on the side of the ball furthest from the electroscope when the dielectric is interposed. To test this I arranged an experiment as follows:—

The knob of a charged Leyden jar was placed midway between two insulated plates of metal, each plate being in connection with an electroscope. The leaves of each electroscope now diverged to an equal extent.

A plate of ebonite was now placed between the knob of the jar and one of the plates. If the statement above quoted is

correct, the leaves of the electroscope in connection with this plate should show an increased divergence, but the reverse effect was observed. *The leaves partially collapsed.* In all experiments that I have made by inserting dielectrics between a charged body and an electroscope, less electric action has been the result. If while the charged ball be near the electroscope the plate of it be touched with the finger, the leaves collapse, and on removing the finger and then the charged ball they again diverge.

Now let a dielectric be placed between the ball and the electroscope, touch the latter, and remove the finger and ball as before, and much greater divergence will be produced. In both cases the electroscope is charged by induction. Without putting the electroscope to earth, I fail to see theoretically why any greater divergence should occur. I suppose someone must have made the experiment as quoted, but if a greater effect was produced it must have been caused by the substance used for a dielectric being charged itself. I have found very great difficulty in preventing plates of ebonite, paraffin, sulphur, &c., becoming electrified when placed near a charged body.

I should like to know if anyone has experimented in this direction, because either the text-books or myself must be wrong.

In Guthrie's book (p. 101) there is a statement similar to Ganot's.

W. A. RUDGE.

Who discovered the Teeth in *Ornithorhynchus*?

ON returning from Central Arizona, where I have been engaged in biological explorations, I find upon my desk an important paper entitled "On the Dentition of *Ornithorhynchus*," by my friend Mr. Oldfield Thomas, Curator of Mammals in the British Museum (see Proc. Royal Soc., vol. xlv, 1889, 126-131, pl. 2).

The opening sentence of this paper is as follows: "At the meeting of the 9th of February, 1888, Mr. E. B. Poulton communicated to this Society the first discovery of the presence of teeth in *Ornithorhynchus*, a discovery which naturally awakened extreme interest throughout the scientific world." A few lines further on Mr. Thomas continues: "The grand fact of the presence of teeth in Monotremes, and their mammalian nature, are discoveries on which Mr. Poulton may well be congratulated."

From the above I infer that considerable stir has been made by the assumed new "discovery" that the young *Ornithorhynchus* has teeth.

If my British colleagues will turn to the masterly work of their illustrious countryman, Sir Everard Home, they will find in the second volume of his "Lectures on Comparative Anatomy" (published in 1814), no less than three beautifully engraved plates, containing eight figures, of the skull and mouth parts of *Ornithorhynchus*. Four of these figures show the teeth—two on each side of each jaw. The explanation accompanying Fig. 1, Tab. lix., is as follows: "A view of the upper jaw and palate, to show that there are two grinding teeth on each side." Fig. 2 is "a similar view of the under jaw."

Washington, D.C., October 12.

C. HART MERRIAM.

ON THE HARDENING AND TEMPERING OF STEEL.¹

I.

THE fact that the British Association meets this year at Newcastle no doubt suggested to the Council that it would be well to provide, for the first time since 1848, a lecture on a metallurgical subject. In that year a discourse was delivered at Swansea by Dr. Percy, one of the most learned metallurgists of our time, who has recently passed away, after having almost created an English literature of metallurgy by the publication of his well-known treatises, without which it would have been comparatively barren. It was to him that the country turned in 1851 when it became evident that our metallurgists must receive scientific training.

I know that it has occurred to many that the various problems involved in the "hardening and tempering of steel" must be incapable of adequate treatment in the brief limits of a discourse like this, while others will think

that the details of the process, which is practised daily in thousands of workshops, are so well known that it is unnecessary to devote a lecture to the subject. It seemed to me that the entire question was the most important I could choose, partly because it will enable a large number of people who are engaged in industrial work, and who are not expected to think about it in a scientific way, to know how such facts as we shall have to examine have been dealt with by scientific investigators; while those of our members who do not consider that their thoughts or work are scientific in its strictest sense, may perhaps be interested to see how absolutely industrial progress depends upon the advancement of science. This consideration has led me to deal with the subject in a somewhat comprehensive way. The treatment of iron in its several forms is the thing that we as a nation do well. If it be true that national virtues are manifestly expressed in the industrial art of a people, we may recall the sentence in Mr. Ruskin's "Crown of Wild Olive" in which he says, "You have at present in England only one art of any consequence—that is, iron-working," adding, with reference to the manufacture of armour-plate, "Do you think, on those iron plates your courage and endurance are not written for ever, not merely with an iron pen, but on iron parchment?" It may be well, therefore, to consider what properties iron possesses which entitle its application to industrial use to specially represent the skill and patience of the nation.

In 1863, Lord Armstrong, in his address as President of this Association, expressed the hope "that when the time again comes round to receive the British Association in this town, its members will find the interval to have been as fruitful as the corresponding period," since the previous meeting in 1838, "on which they were then looking back." In one way at least this hope has been realized, for the efforts of the last twenty years have resulted in the development of an "age of steel." When the Association last met here, steel was still an expensive material, although Bessemer had, seven years before, communicated his great invention to the world through the British Association at its Cheltenham meeting. The great future in store for Siemens's regenerative furnace, which plays so important a part in the manufacture of steel, was confidently predicted in his Presidential address by Lord Armstrong, than whom no one was better able to judge, for no one had done more to develop the use of steel of all kinds.

Steel, we shall see, is modified iron. The name iron is in fact a comprehensive one, for the mechanical behaviour of the metal is so singularly changed by influences acting from within and without its mass, as to lead many to think, with Paracelsus, that iron and steel must be two distinct metals, their properties being so different. Pure iron may be prepared in a form as pliable and soft as copper, steel can readily be made sufficiently hard to cut glass, and notwithstanding this extraordinary variance in the physical properties of iron and certain kinds of steel, the chemical difference between them is comparatively very small, and would hardly secure attention if it were not for the importance of the results to which it gives rise. We have to consider the nature of the transformations which iron can sustain, and to see how it differs from steel, of which an old writer has said, "Its most useful and advantageous property is that of becoming extremely hard when ignited and plunged into cold water, the hardness produced being greater in proportion as the steel is hotter and the water colder. The colours which appear on the surface of steel slowly heated direct the artist in tempering or reducing the hardness of steel to any determinate standard." There is still so much confusion between the words "temper," "tempering," and "hardening," in the writings of even very eminent authorities, that it is well

¹ A Lecture delivered on September 13, by Prof. W. C. Roberts-Austen, F.R.S., before the members of the British Association.

² "The First Principles of Chemistry," by W. Nicholson, p. 312 (London, 1790).